

What is claimed is:

1. A semiconductor device comprising:
 - (a) a semiconductor chip having over a main surface thereof a plurality of first electrode pads formed as exposed areas of a metallic film which contains aluminum (Al) as a main component;
 - (b) a wiring substrate over which the semiconductor chip is mounted and which has a plurality of second electrode pads formed over a main surface thereof; and
 - (c) electrically conductive wires for connecting the first and second electrode pads with each other, the electrically conductive wires containing gold (Au) as a main component and comprising ball portions formed over the first electrode pads, bonded portions formed over the second electrode pads, and wire portions for connecting the ball portions and the bonded portions with each other, the ball portions being bonded to the first electrode pads through an alloy layer of Al and Au,
 - (d) wherein palladium (Pd) is contained in the electrically conductive wires, and
 - (e) wherein the distance between central positions between the adjacent first electrode pads is shorter than 65 μm .
2. A semiconductor device according to claim 1, wherein the distance between central positions of the adjacent first electrode pads is not longer than 50 μm .

3. A semiconductor device comprising:
- (a) a semiconductor chip having over a main surface thereof a plurality of first electrode pads formed as exposed areas of a metallic film which contains aluminum (Al) as a main component;
 - (b) a wiring substrate over which the semiconductor chip is mounted and which has a plurality of second electrode pads formed over a main surface thereof; and
 - (c) electrically conductive wires for connecting the first and second electrode pads with each other, the electrically conductive wires containing gold (Au) as a main component and comprising ball portions formed over the first electrode pads, bonded portions formed over the second electrode pads, and wire portions for connecting the ball portions and the bonded portions with each other, the ball portions being bonded to the first electrode pads through an alloy layer of Al and Au,
 - (d) wherein palladium (Pd) is contained in the electrically conductive wires, and
 - (e) wherein the diameter of a maximum external form of each of the ball portions is smaller than 55 μm .
4. A semiconductor device according to claim 3, wherein the diameter of the maximum external form of each of the ball portions is not larger than 40 μm .
5. A semiconductor device comprising:

- (a) a semiconductor chip having over a main surface thereof a plurality of first electrode pads as exposed areas of a metallic film which contains aluminum (Al) as a main component;
- (b) a wiring substrate over which the semiconductor chip is mounted and which has a plurality of second electrode pads formed over a main surface thereof; and
- (c) electrically conductive wires for connecting the first and second electrode pads with each other, the electrically conductive wires containing gold (Au) as a main component and comprising ball portions formed over the first electrode pads, bonded portions formed over the second electrode pads, and wire portions for connecting the ball portions and the bonded portions with each other, the ball portions being bonded to the first electrode pads through an alloy layer of Al and Au,
- (d) wherein palladium (Pd) is contained in the electrically conductive wires, and
- (e) wherein the diameter of each of the wire portions is smaller than 25 μm .

6. A semiconductor device according to claim 5, wherein the diameter of each of the wire portions is not larger than 20 μm .

7. A semiconductor device according to any of claims 1 to 6, wherein the thickness of the metallic film is not

smaller than 1000 nm.

8. A semiconductor device according to any of claims 1 to 6, wherein the thickness of the metallic film is not larger than 400 nm.

9. A semiconductor device comprising:

(a) a semiconductor chip having over a main surface thereof a plurality of first electrode pads as exposed areas of a metallic film which contains aluminum (Al) as a main component;

(b) a wiring substrate over which the semiconductor chip is mounted and which has a plurality of second electrode pads formed over a main surface thereof; and

(c) electrically conductive wires for connecting the first and second electrode pads with each other, the electrically conductive wires containing gold (Au) as a main component and comprising ball portions formed over the first electrode pads, bonded portions formed over the second electrode pads, and wire portions for connecting the ball portions and the bonded portions with each other, the ball portions being bonded to the first electrode pads through an alloy layer of Al and Au,

(d) wherein palladium (Pd) is contained in the electrically conductive wires, and

(e) wherein the thickness of the metallic film is not smaller than 1000 nm.

10. A semiconductor device comprising:

- (a) a semiconductor chip having over a main surface thereof a plurality of first electrode pads as exposed areas of a metallic film which contains aluminum (Al) as a main component;
- (b) a wiring substrate over which the semiconductor chip is mounted and which has a plurality of second electrode pads formed over a main surface thereof; and
- (c) electrically conductive wires for connecting the first and second electrode pads with each other, the electrically conductive wires containing gold (Au) as a main component and comprising ball portions formed over the first electrode pads, bonded portions formed over the second electrode pads, and wire portions for connecting the ball portions and the bonded portions with each other, the ball portions being bonded to the first electrode pads through an alloy layer of Al and Au,
- (d) wherein palladium (Pd) is contained in the electrically conductive wires, and
- (e) wherein the thickness of the metallic film is not larger than 400 nm.

11. A semiconductor device according to any of claims 1 to 10, wherein the wiring substrate is formed of a glass fabric-based epoxy resin.

12. A semiconductor device according to any of claims 1 to

10, wherein the wiring substrate is formed of a glass fabric-based epoxy resin, and the semiconductor chip and the electrically conductive wires are sealed with a molding resin.

13. A semiconductor device according to any of claims 1 to 10, wherein the wiring substrate is constituted by a resin tape.

14. A semiconductor device according to any of claims 1 to 10, wherein the concentration of the palladium (Pd) contained in the electrically conductive wires in the (d) is approximately 1 wt.%.

15. A method of manufacturing a semiconductor device, comprising the steps of:

- (a) providing a wiring substrate having a plurality of second electrode pads formed over a main surface thereof;
- (b) mounting a semiconductor chip over the wiring substrate, the semiconductor chip having over a main surface thereof a plurality of first electrode pads formed as exposed areas of a metallic film which contains aluminum (Al) as a main component; and
- (c) connecting the first electrode pads and the second electrode pads with each other through electrically conductive wires which contain gold (Au) as a main component,

the step (c) comprising the steps of:

(c1) melting over the first electrode pads one ends of the electrically conductive wires and bonding the resulting melted balls over the first electrode pads;

(c2) bonding opposite ends of the electrically conductive wires over the second electrode pads; and

(c3) forming the electrically conductive wires having ball portions formed over the first electrode pads, bonded portions formed over the second electrode pads, and wire portions for connecting the ball portions and the bonded portions with each other, the ball portions being bonded to the first electrode pads through an alloy layer of Al and Au,

(d) wherein palladium (Pd) is contained in the electrically conductive wires, and

(e) wherein the step (c1) is carried out in a state in which the temperature of the main surface of the semiconductor chip is not higher than 200°C.

16. A method according to claim 15, wherein the wiring substrate is formed of a glass fabric-based epoxy resin.

17. A method according to claim 15, further comprising a step of sealing the semiconductor chip and the electrically conductive wire with a molding resin.

18. A method according to claim 15, wherein the wiring substrate is constituted by a resin tape.

19. A method according to claim 15, wherein the distance

between central positions of the adjacent first electrode pads is not longer than 50 μm .

20. A method according to claim 15, wherein the distance between central positions of the adjacent first electrode pads is shorter than 65 μm .

21. A method according to claim 15, wherein the diameter of a maximum external form of each of the ball portions is smaller than 55 μm .

22. A method according to claim 15, wherein the diameter of a maximum external form of each of the ball portions is not larger than 40 μm .

23. A method according to claim 15, wherein the diameter of each of the wire portions is not larger than 25 μm .

24. A method according to claim 15, wherein the diameter of each of the wire portions is not larger than 20 μm .

25. A method according to claim 15, wherein the thickness of the metallic film is not smaller than 1000 nm.

26. A method according to claim 15, wherein the thickness of the metallic film is not larger than 400 nm.

27. A method according to claim 15, wherein the concentration of the palladium (Pd) contained in the electrically conductive wires is approximately 1 wt.%.